

IN THE SPECIFICATION

Please amend the paragraphs in the specification as follows:

On page 1:

1. The last paragraph, lines 15-18:

A network management system can monitor the state of a communication network all of the time in order to maintain the network in an optimal state, and can collect network state information, alarm information, and traffic data. When network alarm information is not handled efficiently, there can be inconvenience and difficulty.

On pages 4-9:

2. The paragraphs starting at line 2 on page 4 and ending at line 17 on page 9:

According to another aspect of the present invention, an alarm management processor ~~makes~~ creates an uncleared alarm table for storing alarm information that was generated from a network and is not cleared yet, and a cleared alarm table for storing cleared alarm information in the alarm management method. Then, the alarm management processor ~~makes~~ creates a plurality of listener tables corresponding to alarm managers connected to the alarm management processor, and registers the listener tables in a broadcasting list table. Upon generation of alarm information from a network, the alarm management processor stores alarm information in the uncleared alarm table and the listener tables registered in the broadcasting list table. The alarm managers read the alarm information from the listener tables. When the alarm is released, the alarm management processor clears the alarm information from the uncleared alarm table and stores the alarm information in the cleared alarm table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides an apparatus[[,]] comprising: a management information system for outputting alarm

information corresponding to an alarm event, and for outputting an alarm clear signal corresponding to an end of said alarm event; an alarm management host receiving said alarm information, said host having a broadcasting list data table, said host having an alarm database including a first data table and a second data table, said host having a plurality of memory spaces and a plurality of listener tables; a processor [[being]] coupled to said host, said processor storing said alarm information in said first data table when said alarm information is received by said host, said processor removing said alarm information from said first data table and storing said alarm information in said second data table when said alarm event is cleared, said alarm event being cleared when said alarm clear signal is output; and a plurality of alarm managers [[being]] connected to said host, said plurality of alarm managers including a first alarm manager, said listener tables including a first listener table corresponding to said first alarm manager, each of said listener tables having a unique name listed in said broadcasting list data table, said first listener table having a first unique name; said processor storing said alarm information in each of said listener tables listed in said broadcasting list data table; after said storing of said alarm information in said listener tables is completed, said alarm managers reading said alarm information stored in said respective listener tables; when said reading of said alarm information is performed, said alarm managers performing at least one selected from among displaying said alarm information, printing said alarm information, transmitting an e-mail message including said alarm information, transmitting a pager message including said alarm information, and transmitting a facsimile message including said alarm information; when said reading of said alarm information is performed, said alarm managers removing said alarm information from said listener tables to prevent re-reading of said alarm information; when said management information system performs said outputting of said alarm clear signal, said processor performing said ~~removing~~ removal of said alarm information from said first data table and performing said storing of said alarm information in said second data table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides a method[[,.]] comprising the steps of: outputting alarm information corresponding to an alarm event and outputting an alarm clear signal corresponding to an end of said alarm event, said outputting being performed by a network; receiving said alarm information, said receiving being performed by a host, said host having a broadcasting list data table, a plurality of memory spaces, a plurality of listener tables, and an alarm database including a first data table and a second data table; when said alarm information is received by said host, storing said alarm information in said first data table; when said alarm event is cleared, removing said alarm information from said first data table and storing said alarm information in said second data table, said alarm event being cleared in response to said outputting of said alarm clear signal; connecting a plurality of alarm managers to said host, said plurality of alarm managers including a first alarm manager, said listener tables including a first listener table corresponding to said first alarm manager, each of said listener tables having a unique name listed in said broadcasting list data table, said first listener table having a first unique name; storing said alarm information in each of said listener tables listed in said broadcasting list data table; after said storing of said alarm information in said listener tables is completed, reading said alarm information stored in said listener tables, said reading of said alarm information stored in said listener tables corresponding to each one of said respective alarm managers reading said alarm information stored in each one of said respective listener tables; when said reading of said alarm information is performed by said alarm managers, performing at least one selected from among displaying said alarm information, printing said alarm information, transmitting an e-mail message including said alarm information, transmitting a pager message including said alarm information, and transmitting a facsimile message including said alarm information; when said reading of said alarm information is performed, removing said alarm information from said listener tables to prevent re-reading of said alarm information; and when said management information system

performs said outputting of said alarm clear signal, performing said ~~removing~~ removal of said alarm information from said first data table, and performing said storing of said alarm information in said second data table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides an alarm management method for a network management system, the method comprising the steps of: ~~making~~ creating an uncleared alarm table for storing alarm information that is generated from a network and that is not cleared, and ~~making~~ creating a cleared alarm table for storing alarm information that is cleared; storing first alarm information in the uncleared alarm table when the first alarm information is generated from the network, said first alarm information corresponding to an alarm event; and when the alarm event ends, removing said first alarm information from the uncleared alarm table and storing the first alarm information in the cleared alarm table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides an alarm management method for managing an alarm in a network, said method comprising the steps of: creating a plurality of listener data tables for storing information, each one of said listener data tables corresponding to one respective alarm manager selected from among a plurality of alarm managers, each one of said listener data tables having a unique name; detecting whether said alarm managers are operating normally; registering in a broadcasting list data table said unique names identifying said listener data tables corresponding to said alarm managers that are detected to be operating normally; when an alarm event is generated in said network, storing first alarm information in said listener data tables corresponding to said names registered in said broadcasting list data table; and reading said first alarm information from said listener data tables by said corresponding alarm managers.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides an alarm management method for an alarm management processor connected to a plurality of alarm managers, the method comprising the steps of: ~~making~~ creating an uncleared alarm table for storing alarm information corresponding to an alarm event that is generated from a network and that is not cleared, and ~~making~~ creating a cleared alarm table for storing alarm information corresponding to an alarm event that is cleared; ~~making~~ creating a plurality of listener tables corresponding to the alarm managers; registering the listener tables in a broadcasting list table; storing alarm information in the uncleared alarm table when the alarm event is generated from the network; storing the alarm information in the listener tables registered in the broadcasting list table; reading the alarm information from the listener tables, said reading being performed by the alarm managers; and when the alarm event is released, clearing the alarm information from the uncleared alarm table and storing the alarm information in the cleared alarm table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides an apparatus for managing an alarm event occurring in a network, said ~~system~~ apparatus comprising: a management information system for outputting alarm information corresponding to an alarm event; an alarm management host computer for managing said alarm information received from said management information system; and a plurality of alarm managers ~~[[being]]~~ connected to said alarm management host computer, said plurality of alarm managers reading said alarm information when said alarm information is not cleared, said plurality of alarm managers including a first alarm manager; said alarm management host computer having a first data table for storing said alarm information when said alarm information is not cleared, and a second data table for storing said alarm information when said alarm information is cleared, said alarm management host computer storing said alarm information in said first data table when

said alarm information is not cleared, said alarm management host computer removing said alarm information from said first data table and storing said alarm information in said second data table when said alarm information is cleared, said alarm information being cleared when said alarm event ends.

On page 10:

3. The paragraphs starting at line8, ending at line 15:

FIG. 2 is a block diagram of an alarm management system[[,]] in accordance with the principles of the present invention;

FIG. 3 is a flowchart illustrating an alarm management operation[[,]] in accordance with the principles of the present invention;

FIG. 4 is a detailed flowchart illustrating a recording and reading operation in tables[[,]] in accordance with the principles of the present invention; and

FIG. 5 is a flowchart illustrating a recording and reading operation in listener tables[[,]] in accordance with the principles of the present invention.

On page 11:

4. The first paragraph, lines 5-13:

In the interest of clarity, not all features of an actual implementation are described. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail. It will be appreciated that, in the development of any actual embodiment, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill having the benefit of this disclosure.

On pages 11-12:

5. The paragraph starting at line 17 on page 11, ending at line 10 on page 12:

FIG. 1 is a block diagram of a network alarm management system. Referring to FIG. 1, a computer-based management information system (MIS) 110 collects state information generated from a network. The management information system 110 is a system that includes computer hardware, software, data, procedures, and people as its components, for processing and processes data generated from the network and produces diverse pieces of information. Especially, upon notification of generation of an alarm event from the management information system 110, an alarm management processor 120 of an alarm management host computer 100 stores information about the alarm event in a predetermined form in an alarm database 130 formatted ~~[[in]]~~ as a single structural table. A plurality of alarm managers 140 to 144 displays uncleared alarm information in real time, referring to the alarm database 130. An alarm event can be an error that occurs during a data transmission, a quantity of errors exceeding a predetermined amount, a network component failing to respond to polling, or any other type of fault condition.

On pages 12 and 13:

6. Paragraphs starting at line 15 on page 12, ending at line 10 on page 13:

The operation of many alarm managers causes a heavy load on the single alarm table when they refer to the table. Consequently, the performance of the alarm managers is remarkably decreased, and ~~[[an]]~~ alarm history is reviewed at a lower speed. In addition, since all of the alarm managers share the single alarm table, an alarm management application program should be developed to search the alarm table every time a new NMS is implemented.

FIG. 2 is a block diagram of an alarm management system according to the present invention. Referring to FIG. 2, an alarm management host computer 200 is a workstation for managing a network, including and includes an alarm management processor 220, a

broadcasting list table 230, an alarm database 240, and a plurality of listener tables 250 to 253.

The alarm management processor 220 operates according to an alarm management application program [[being]] which is a daemon application program. As is known, a daemon is a resident program that executes computer system-associated operations in the background. That is, when a task to be processed occurs, the alarm management daemon is automatically invoked from the background and implements the task. A daemon is a program that is not invoked explicitly, but lies dormant waiting for [[same]] some condition to occur.

On page 14:

7. The first paragraph, lines 6-11:

To prevent this problem, the alarm managers 260 to 263 each secure unique alarm information sensing areas, specifically, listener tables 250 to 253. The names of the listener tables 250 to 253 are registered in the broadcasting list table 230. Alarm information generated from the network is stored in both the uncleared alarm table 243 and the listener tables 250 to 253 at the same time. The alarm managers 260 to 263 each read alarm information from their respective listener tables 250 to 253.

On pages 15-16:

8. The paragraphs starting at line 3 on page 15, ending at line 4 on page 16:

FIG. 3 is a flowchart illustrating an alarm management operation according to the present invention. Referring to FIG. 2 and FIG. 3, the alarm management processor 220 [[makes]] creates the uncleared alarm table 243 and the cleared alarm table 245 within the alarm database 240 in step S110. Since the number of uncleared alarms is normally smaller than that of cleared alarms, the uncleared alarm table 243 should be smaller than the cleared alarm table 245.

In step S120, the alarm managers 260 to 263 connected to the alarm management host computer 200 secure memory space for use as listener tables in the host computer 200 using their process identifiers (IDs), and generate the listener tables 250 to 253. In step S130, the alarm managers 260 to 263 store the names of their listener tables 250 to 253 in the broadcasting list table 230. For example, the names of the listener tables 250 to 253 can be the process identifiers of the alarm managers 260 to 263. If one of the alarm managers 260 to 263 is inoperative, the name of its listener table is cleared from the broadcasting list table 230.

If an alarm is generated from the network, the alarm management processor 220 stores information about the alarm in the uncleared alarm table 243 in step S140. The step ~~[[of]]~~ S140 will be described in detail hereinbelow.

Upon generation of an alarm from the network, the management information system (MIS) 110 transmits an alarm generation event message representing generation of the alarm to the host computer 200. An alarm event message generated from the management information system (MIS) 210 typically includes the ~~following~~ fields, as shown in Table 1 below.

On pages 16-18:

9. The paragraphs starting at line 20 on page 16, ending at line 5 on page 18:

In step S150, the alarm management processor 220 stores the alarm information in the listener tables 250 to 253. The step ~~[[of]]~~ S150 will be described in detail hereinbelow.

After generating the alarm information, the alarm management processor 220 ~~checks~~ determines whether each of the alarm managers 260 to 263 with the listener tables 250 to 253 registered in the broadcasting list table 230 ~~each operate~~ operates normally. If

processor 220 senses that an abnormal alarm manager exists, the name of its listener table is cleared from the broadcasting list table 230 in order to prevent unnecessary storage of the alarm information in the listener table of the abnormal alarm manager.

Then, the alarm management processor 220 simultaneously transmits all alarm information to the registered listener tables 250 to 253 referring to the broadcasting list table 230. Before the alarm information is stored in the listener tables 250 to 253, the alarm management processor 220 sets the listener tables 250 to 253 to a lock mode so that the alarm managers 260 to 263 cannot access the listener tables 250 to 253 during recording of the alarm information. When the recording operation is completed, the alarm management processor 220 releases the listener tables 250 to 253 from the lock mode to allow the alarm managers 260 to 263 to access the listener tables 250 to 253.

In step S160, the alarm managers 260 to 263 determine whether alarm information is stored in their respective listener tables 250 to 253 periodically or when an operator requests. If the stored alarm information exists, the alarm managers 260 to 263 read the alarm information, display or print the alarm information, and clear or remove the alarm information from the listener tables 250 to 253 to prevent re-reading of the alarm information. Also, the alarm managers 260 to 263 can transmit an e-mail message including the alarm information, transmit a pager message including the alarm information to a pager 500, and can transmit a fax message including the alarm information to a remote fax machine 510.

Pages 18-20:

10. The paragraphs starting at line 17 on page 18, ending at line 6 on page 20:

Unless information about a cleared alarm is automatically cleared due to problems, including a line abnormality between the management information system (MIS) 210 and

the host computer 200, an operator can request the alarm management processor 220 to manually clear the alarm information using the alarm managers 260 to 263. Upon the request [[of]] for a manual clear, the alarm management processor 220 clears the alarm information from the uncleared alarm table 243 and stores the alarm information in the cleared alarm table 245.

FIG. 4 is a flowchart illustrating a recording and reading operation in the tables according to the present invention. Referring to FIG. 2 and FIG. 4, in step S01, upon receipt of an alarm generation event message from the management information system 210, the alarm management processor 220 stores corresponding alarm information in a listener table 0001 (250) registered in the broadcasting list table 230. A corresponding alarm manager 260 reads the alarm information from the listener table 250 by polling periodically or every time an alarm is generated.

In step S02, upon receipt of an alarm clear event message from the management information system 210, the alarm management processor 220 looks up corresponding alarm information in the uncleared alarm table 243, clears the alarm information, and automatically inserts the alarm information [[in]] into the cleared alarm table 245. The alarm manager 260, 261, 262 or 263, especially when it wants to review an alarm history, may monitor changes of alarm information in the uncleared alarm table 243 and the cleared alarm table 245, and may display them on a display.

In step S03, if the operation requests the alarm management processor 220 to manually clear alarm information using the alarm manager 260, 261, 262 or 263, the alarm management processor 220 looks up the alarm information in the uncleared alarm table 243, clears it from the uncleared alarm table 243, and stores it in the cleared alarm table 245.

In step S04, when the alarm management procedure ends due to power-off of the computer of the alarm manager 260, 261, 262 or 263 or termination of its application program, the alarm manager 260, 261, 262 or 263 requests the alarm management processor 220 to clear its listener table before the procedure ends. In response to the request, the alarm management processor 220 deletes the listener table.

Pages 20-21:

11. The paragraphs starting at line 10 on page 20, ending at line 11 on page 21:

Referring to FIG. 5, the alarm management processor 220 sets ~~listener table #0001~~ named listener_0001 in listener table 250 to a lock mode, records generated alarm information in listener_0001 table #0001, and then releases it from the lock mode in step S11. The reason for the alarm management processor 220 to set listener_0001 table #0001 to the lock mode is to prevent alarm manager 260 #0001 corresponding to listener_0001 table #0001 from accessing listener_0001 table #0001 during recording of the alarm information. In step S12, alarm manager 260 #0001 sets listener_0001 table #0001 to the lock mode, reads the alarm information from listener_0001 table #0001, and then releases it from the lock mode. The reason for alarm manager 260 #0001 to set listener_0001 table #0001 to the lock mode is to prevent the alarm management processor 220 from accessing listener_0001 table #0001 during reading of the alarm information.

Similarly, the alarm management processor 220 sets listener_0002 tables #0002 and listener_0003 #0003 to the lock mode, records the same alarm information in listener_0002 tables #0002 and listener_0003 #0003, and then releases them from the lock mode in steps S13 and S15. In steps S14 and S16, alarm managers 261 #0002 and 262 #0003 set listener_0002 tables #0002 and listener_0003, respectively, #0003 to the lock mode, read the alarm information from listener_0002 tables #0002 and listener_0003, respectively, #0003, and then release them from the lock mode.

In accordance with the present invention as described above, alarm information is readily looked up using distributed multiple tables for alarm management in a network management system, thereby saving time and ~~efforts~~ effort on the part of an operator. Since a plurality of alarm managers have their respective listener tables, the problem of asynchronous access to alarm information is solved, and load during the access is decreased.

Pages 21-22:

12. The paragraph starting at line 17 on page 21, ending at line 7 on page 22:

While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the ~~applicant~~ inventor to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the ~~applicant's~~ general inventive concept.